

REMARKS

The Examiner is thanked for the careful examination of this application. Claims 1-10 and 22-34 have been canceled without prejudice solely for the purpose of expediting the prosecution of this application. Applicant reserves the right to pursue the canceled claims in one or more continuing applications without limitation or estoppel. Claims 11, 12 and 14-21 are currently pending in this application.

Claim Rejections – 35 USC §112

Claim 22 was rejected under 35 U.S.C. 112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully traverses. However, solely to expedite the prosecution of this application, claim 22 has been canceled without prejudice. The Examiner is respectfully requested to withdraw his rejection as moot.

Claim Rejections – 35 USC §103

Claims 1 and 3-10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sucher & Holzer Bauplan Handel (AT 406870B), hereafter "Sucher", in view of Peter et al. (WO 03/004591; US 6,933,398), hereafter "Peter", in view of Peterson et al. (JAOCs, Vol. 61, 1984), hereafter "Peterson", and further in view of Foidl (US 5,939,571), hereafter "Foidl", as set out below. While Applicant respectfully traverses, it should be noted that claims 1-10 are canceled without prejudice. Applicant respectfully request that this rejection be withdrawn.

Claims 11, 12 and 14-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sucher in view of Peter, in view of Lever Brothers & Unilever Limited (GB 612,667), hereafter "Lever", in view of Peterson, and further in view of Foidl. Applicant respectfully traverses as set forth below.

There are clear differences, as set forth below, between Applicant's claimed embodiments and those of Peter and, due to these differences, there are unexpected effects in view of the combination of Sucher, Peter, Peterson and Foidl. This is evident in several ways, as noted below.

(1) Comparison of Refluxing Methods

In Peter, the reactants are separated and refined by transesterifying, and thereafter, methyl ester is refluxed (see column 3, lines 57 to 66). However, in presently claimed embodiment, the reaction products transesterified are directly refluxed to the reactors (11 and 14) without going through the glycerine/ester separator (15). That is, unlike Peter, the separated and refined methyl ester is refluxed by Applicant, who refluxes methyl ester and glycerine as the reaction products along with non-reacted tri-, di-, mono-glyceride without any separating process. Thus, there is a substantial difference between two processes (see Fig. 3).

With Peter, refluxing only methyl esters after separating and refining the reaction products can increase the initial reaction rate of alcohol and oil, which are insoluble each other, but shifts reaction equilibrium to the reverse reaction direction by having influence on reaction balance, and thus, although the initial production speed increases, the methyl ester content of the reaction product becomes low.

Further, the initial reaction rate increases due to the characteristic that alcohol and oil, which were insoluble, are solubilized each other, but the driving force of reaction decreases. Thus, the reaction speed decreases extremely after the point of time when the reaction is advanced to some extent, and this becomes a main cause of increasing the size of the reactor of step (a) using homogeneous (or heterogeneous) acid catalyst and step (b) using homogeneous (or heterogeneous) base (or acid) catalyst.

Peter therefore leads to decrease the efficiency of the biodiesel production process compared to Applicant's improved processes.

(2) Free Fatty Acid Content

Unlike Peter, Applicant can obtain the same effect not only at a pre-treatment (an esterification reaction) step but also at a transesterification reaction step as the main reaction for producing fatty acid alkyl esters regardless of the kinds of the catalysts (acid or base and homogeneous or heterogeneous) employed.

That is, Peter et al. use highly refined oil in which the free fatty content is less than 0.5%, preferably less than 0.1% (see column 3, lines 49-52), but Applicant's embodiment reacts the free fatty acid with alcohol at the phase of the pre-treatment reaction irrelevantly to the free fatty acid content, and converts and removes the free fatty acid before the transesterification reaction between oil and alcohol. During the process, the claimed embodiment uses a homogeneous catalyst and a non-homogeneous solid catalyst.

(3) Amount of Reflux Alkanol Fatty Acid Esters

With Peter, the amount of reflux of alkanol fatty acid esters is 5 to 50%, being relatively broad (see column 3, lines 19-21), and in the examples, a large amount of methyl ester are also refluxed (see column 4, Working Examples 1 to 3). This has influence on the reaction balance, and thus, general process efficiency decreases, thereby increasing equipments and operating costs. Accordingly, with Peter, the production costs of bio-diesel oil will be higher than with Applicant.

As noted above, independent claim 11 is considered to be patentable over the cited art, and thus, dependent claims 12 and 14-21 are patentable for at least the same reasons. The Examiner is respectfully requested to withdraw the rejection of pending claims 11, 12 and 14-21.

Claims 22-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sucher in view of Peter, in view of Peterson and further in view of Foidl. While Applicant respectfully traverses, it should be noted that claims 22-34 are canceled

without prejudice. Applicant respectfully request that this rejection be withdrawn as moot.

Conclusion

Applicant respectfully requests a Notice of Allowance for the pending claims of 11, 12 and 14-21. The undersigned can be reached at the telephone number set out below and welcomes a call from the examiner at any time to further expedite prosecution.

Respectfully submitted,

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